

What Is Claimed Is:

*Sub 917* 1. A tunable external cavity waveguide adapted for tuning a semiconductor laser, said tunable external cavity waveguide comprising:

a ferroelectric electro-optical substrate;  
means for creating a waveguide in said substrate; and  
a distributed Bragg reflector (DBR) for selecting a laser oscillation wavelength.

*2/1* 2. A tunable external cavity waveguide according to claim 1 wherein said substrate has an electro-optic coefficient of no less than  $r_{33} = 240$  pm/V and a strain-optic coefficient which is positive.

*3/1* 3. A tunable external cavity waveguide according to claim 2 wherein said substrate has a strain-optic coefficient in the range of about 0.1.

*4/1* 4. A tunable external cavity waveguide according to claim 3 wherein said substrate comprises SBN.

*5/1* 5. A tunable external cavity waveguide according to claim 4 wherein said substrate comprises SBN:61.

*6/1* 6. A tunable external cavity waveguide according to claim 4 wherein said substrate comprises SBN:75.

*7/1* 7. A tunable external cavity waveguide according to claim 3 wherein said substrate comprises PLZT.

*8/1* 8. A tunable external cavity waveguide according to claim 3 wherein said substrate comprises  $\text{LiNbO}_3$ .

9 9. A tunable external cavity waveguide according to claim 3 wherein said substrate comprises  $\text{LiTaO}_3$ .

10 10. A tunable external cavity waveguide according to claim 3 wherein said substrate comprises  $\text{BaTiO}_3$ .

11 11. A tunable external cavity waveguide according to claim 1 wherein said waveguide is created in said substrate by inducing a compressive strain field within said substrate, wherein said compressive strain field creates a graduated variation in the index of refraction of said substrate.

12. A tunable external cavity waveguide according to claim 11 wherein said compressive strain field is created by depositing a layer of material on said substrate, wherein said layer of material deposited on said substrate has a different coefficient of thermal expansion than said substrate, and further wherein said layer of material is applied to said substrate at an elevated temperature and then allowed to cool.

13. A tunable external waveguide according to claim 12 wherein said substrate comprises a flat surface and said layer of material is deposited onto said flat surface, and further wherein a channel is formed in said layer of material after cooling.

14. A tunable external cavity waveguide according to claim 12 wherein said substrate comprises a ridge projecting out of a flat surface, and further wherein said layer of material is deposited onto said flat surface adjacent said ridge.

15. A tunable external cavity waveguide according to claim 1 wherein said substrate comprises a ridge projecting out of a flat surface, and further wherein a layer of material is

deposited onto said ridge, said layer of material having a larger index of refraction than said substrate, whereby said waveguide will be created in said substrate.

16. A tunable external cavity waveguide according to claim 1 wherein said substrate comprises a flat surface, and further wherein a layer of material is deposited onto said flat surface, said layer of material comprising a ferroelectric electro-optical material having a larger index of refraction than said substrate.

17. A tunable external cavity waveguide according to claim 1 wherein said waveguide further comprises phase control means for selecting a cavity mode.

18. A tunable external cavity waveguide according to claim 17 wherein said phase control means comprise means for applying a voltage difference across a portion of said waveguide.

19. An external cavity mirror cooperatively disposed with a semiconductor laser for directing a portion of the emitted laser light back into an optically active region of said semiconductor laser, said external cavity mirror comprising a substrate comprising a ferroelectric electro-optical material, a waveguide formed in said substrate, and an electro-optically tunable distributed Bragg reflector (DBR) formed on said substrate, wherein said portion of emitted laser light is directed back into said optically active region of said semiconductor laser as a function of a pre-determined external voltage difference that is selectively applied across said distributed Bragg reflector (DBR).

20. A semiconductor laser comprising:  
an active section adapted to create a light beam by spontaneous emission over a bandwidth around some center

frequency, wherein said active section guides said light beam between an external cavity mirror bounding one end of said active section and a partially reflective mirror bounding an opposite end of said active section so as to create an emitted beam of laser light therefrom;

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ent- said external cavity mirror being cooperatively disposed with said semiconductor laser for directing a selected portion of said light beam back into said active section, said external cavity mirror comprising a substrate comprising:

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a ferroelectric electro-optical material;  
a waveguide formed in said substrate; and  
a distributed Bragg reflector (DBR) formed on said substrate.

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